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Innovation for commercial Sensors:

From stepping into an opportunity Gap to continuous Innovation

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Abstract

Sensirion is a high-tech sensor company with headquarters in Switzerland. Based on technological concepts developed in the mid 90s at ETH Zurich, Sensirion was founded in 1998. Product development started in the same year. Today, Sensirion is a high-tech sensor company, with a highly skilled team of more than 170 employees. About 50% of the manpower is concentrated in R&D. Sensirion successfully manufactures millions of MEMS sensors each year for a wide range of industrial, consumer, medical, and automotive applications. Sensirion is the industry leader for chip based humidity & temperature sensors, mass flow measurement and control devices for gases and liquids, and differential pressure sensors. In this keynote I would like to give you some insights from stepping into an opportunity gap to becoming a leader in the market focusing on one of our product lines, the humidity sensors.

Keywords: Innovation, humidity, sensor

1. Introduction

I would like to thank the committee of the Eurosensors 2010 conference for inviting me to give a key note speech. I intend to give the audience some insights into experiences that Sensirion has made on the business side during the last couple of years, as opposed to further deepen your knowledge on the scientific aspects of sensors.

Twelve years ago, Moritz Lechner and myself started a company with the ambitious aim to become a leader in CMOS based sensors for different physical quantities: humidity & temperature, gas-flow, liquid-flow and others. We were convinced that there was an opportunity gap for such sensors and that it was the right time to start with our endeavour! I would like to illustrate this with the story about the humidity sensors in the following.

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2. Opportunity Gap

When we started our company in the nineties, a humidity sensor consisted of a sensitive element and discrete read out electronics with trimming resistors to calibrate the system, see Fig.1. The existing sensor companies sold either the sensitive element without any calibration, or a complete system. The systems at the time were big and expensive. If a system integrator was not willing to buy the expensive system, but decided to use only the sensitive element, he had to design and assemble the system from scratch and had to calibrate it all by himself. The efforts for someone to develop such a system and the calibration set up were enormous.

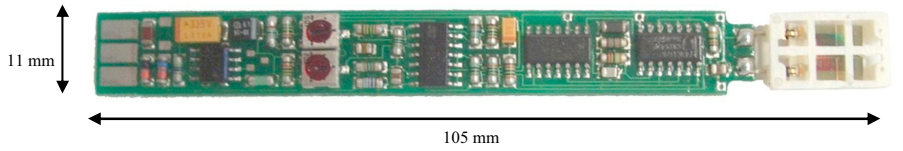

Fig. 1: Typical humidity sensor in the mid 90's

And there was our opportunity gap: By integrating the sensitive element and the discrete read out electronics on one single, monolithic chip, Sensirion revolutionized the way humidity was measured. For the first time it was possible for a user to buy a calibrated small component that replaced the large and expensive system he had to buy before. With our new component it became easy to integrate humidity measurements into any thinkable electronic device. Today, Sensirion is the market leader for humidity sensor components and our method to measure humidity has become the state of the art.

Being the first to satisfy a customer need gives young companies a chance to grow and become leading in a field. The hard thing is to spot a genuine need and to be able to deliver the first practical solution. Then, either you seize that opportunity or you will always stay the follower. In the latter position you will experience that customers will always go with the leader and that the remaining niches are too small to be economically viable.

Besides being the first on the market with an integrated solution, other key features were of great importance too: for example sensor stability in every conceivable environment and a robust package, just to name two. Whereas it is relatively simple to come up with ‘something sensitive to humidity’, it is extremely hard to develop a sensor that is stable in harsh environments with no long term drift. Sensirion has reached this goal by a focused R&D initiative on a long-term basis. Apart from offering the first integrated solution this was the second reason for success - furthermore, was a robust package.

3. Humidity Sensor Packaging History

Fig.2 to Fig.4 shows Sensirion’s innovation in packaging developments over the last 10 years.

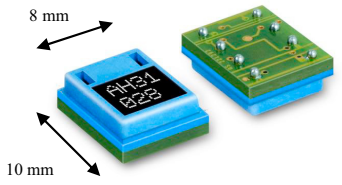

Fig. 2: First product: AH31

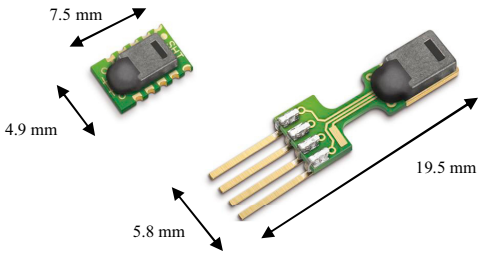

Fig. 3: Actual high runner (launched in 2001): SHT11 and SHT75

The very first sensor package shown in Fig.2, was a ball grid array (BGA) package built by using chip on board (COB) technology. The next generation was a package having its external connection not via a BGA but with contacts on both sides, shown in Fig.3. Today this product is still a long runner. It also uses COB technology. The latest package is a dual flat no leads (DFN), shown in Fig.4, which is related to the quad flat no leads (QFN) that is better known in industry. In order to offer innovative solutions for the customer on one hand and to guarantee the highest quality on the other Sensirion decided to establish its own proprietary, in house packaging line. The effort involved in developing such a package and its manufacturing processes were very costly and time consuming. However, since Sensirion has started to run its own packaging line and processes, we have been able to further strengthen our leading position in the market.

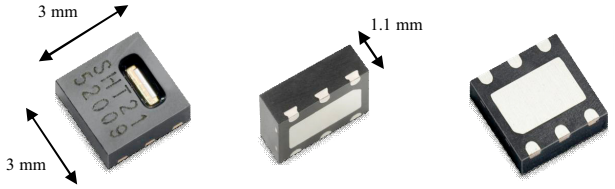

Fig. 4: Latest development (launched in 2009): SHT 21

4. Other Sensors

This short history about Sensirion's humidity sensors reveals the ingredients that enabled us to grow from 2 to over 170 employees during the last 12 years. Moreover, humidity sensors are only one of many more sensor types Sensirion develops and sells. These range from gas flow over liquid flow to differential pressure and temperature sensors, see Fig.5.

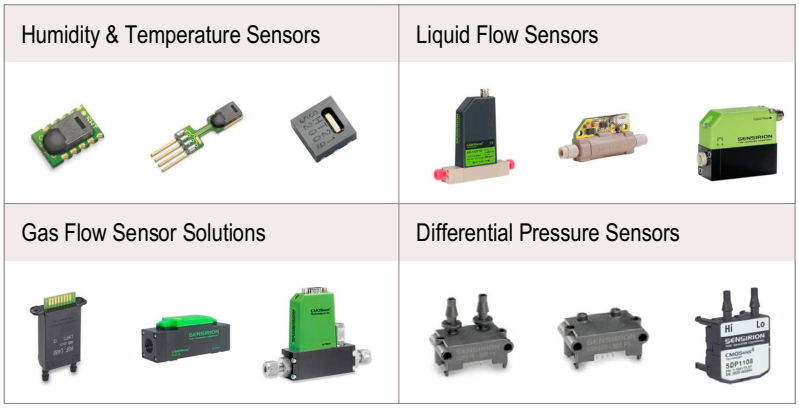

Fig. 5: Sensirion's fields of sensor solutions. These are just a few examples. The variety of different package solutions is much bigger.

Since I do not want to bore you with the details of the other product's stories I will tell you what they have in common with the humidity sensors: Spot the opportunity gap and be quick and persistent to get into the market!

5. Continuous Innovation

Once you are in the market you need to innovate continuously. Making our existing sensors better, developing new sensors, and keeping our leading position in the market is an extremely interesting challenge, especially to young engineers. Also the story of the humidity sensor I introduced to you in this paper goes on. Besides ramping up our latest innovation, the SHT21 shown in Fig. 4, our R&D crew already starts to develop the next generation. The next sensor will again have more functionality on one hand and, like every devices in microelectronics, become smaller and cheaper. To continuously be innovative still almost half of our company's staff works in R&D! Moreover, we are proud to hire up to 5 new engineers every month, which makes us one of the top employers in the field of sensors today.

6. Conclusions

Because many in the audience are from universities, I would like to summarise the message of my key note especially for you:

1. There is a right time for everything. Investigate the new and do not reinvent the existing.
2. Packaging is a big issue! Universities should do more on education in packaging. It is vital for the European sensor industry to have young creative packaging engineers.

Acknowledgements

Let me finish by thanking all staff at Sensirion. They are behind our success story. They did all the work!

References

For more information see: www.sensirion.com